St. Louis Metro Area Rail Gateway Enterprise

DRAFT ENVIRONMENTAL IMPACT STATEMENT
Technical Supplement
OPERATIONAL AND COST ANALYSES OF THE RESTRUCTURING ALTERNATIVES
Volume One

DEPARTMENT OF TRANSPORTATION ★ UNITED STATES OF AMERICA ★

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TECHNICAL SUPPLEMENT

OPERATIONAL AND COST ANALYSES OF RESTRUCTURING ALTERNATIVES: VOLUME ONE

ST. LOUIS METRO AREA
RAIL GATEWAY ENTERPRISE

Prepared for:

Federal Railroad Administration
Illinois Department of Transportation
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June, 1981

EXECUTIVE SUMMARY

The efforts of the Federal Railroad Administration (FRA) toward resolving the problems of the St. Louis Gateway through railroad improvements have been focused into a three phase program entitled the Metro Area Rail Gateway Enterprise or MARGE. The program focused on accomplishing the following three objectives:

- To improve the efficiency of railroad operations within the St. Louis Terminal
- To reduce rail/community conflicts
- To provide opportunities for economic and community development.

This report summarizes the Phase II studies, which consist of efforts to refine the restructuring plans, to resolve the various rail institutional issues, and to define the community and environmental impact issues. Phase II includes a estimation of costs and benefits for each of the railroads involved, together with a comprehensive cost/benefit analysis of the railroad restructuring, and will culminate in the publication of an Environmental Impact Statement.

The MARGE project proposes consolidation of many of the smaller rail yards in the Gateway area into two or three major common facilities (the Two-Yard and Three-Yard Alternatives). Phase II examined two operational alternatives for the Three-Yard plan, Directional and Bidirectional. These alternatives are fully described in this Report, along with existing conditions in the Gateway and the required No-Build Alternative.

The analyses performed in Phase II led to two major conclusions:

- Implementing any of the Build Alternatives would be more favorable with regard to rail operations than continuing with the current (No-Build) facilities and strategies
- The Three-Yard Bidirectional Alternative shows the most improvement when compared to the No-Build on the bases of transit time, reliability and cost of operations, and generally has fewer adverse environmental impacts than the other alternatives.

The studies which led to these conclusions are summarized herein, and fully documented in the second volume of this Technical Supplement.

TABLE OF CONTENTS

PROJECT DESCRIPTION

Background

The St. Louis railroad complex, alternately called a "Gateway" or a "Terminal", is of major importance to the national railroad network, and its vitality is critical to the industrial and economic health of the region. Geographically, it lies near the nation's center. Situated on the banks of the Mississippi, the Gateway takes in portions of the States of Missouri and Illinois (see Exhibit A). On the west side, the majority of the rail facilities lie near the river. On the east side, however, the network extends eastward some five miles to include the Alton & Southern (A&S) Corridor east of Washington Park. The major Illinois communities within the project area are East St. Louis, Granite City, Madison, Venice, Brooklyn, Cahokia, Centreville, Alorton, Dupo, Washington Park and Fairmont City. The southern boundary is the Bixby Rail Junction south of Dupo, and the northern boundary is Lenox Rail Tower in Mitchell. Exhibit A shows the St. Louis Gateway area.

The St. Louis Gateway is the second largest rail traffic routing center in the nation. The network includes track or facilities belonging to 14 major (Class I) railroad companies, and 3 Class II (switching) carriers. There are approximately 82 miles of mainline corridors in the gateway area. The sorting of cars into groups, or cuts, for delivery to individual railroads is mainly accomplished in two large common classification yards, Madison Yard on the north and Gateway Yard on the south. Specific classifications for distant points in the country are performed in a series of "home" yards where individual railroads also handle trailer traffic. Gateway Yard is operated by the Alton and Southern Railroad, while the Terminal Railroad Association (TRRA), a corporation composed of eleven railroads operating in the complex, manages the functions of Madison Yard. Individual roads are charged by either of these switching carriers for the rail cars which go through the classification process in their facilities.

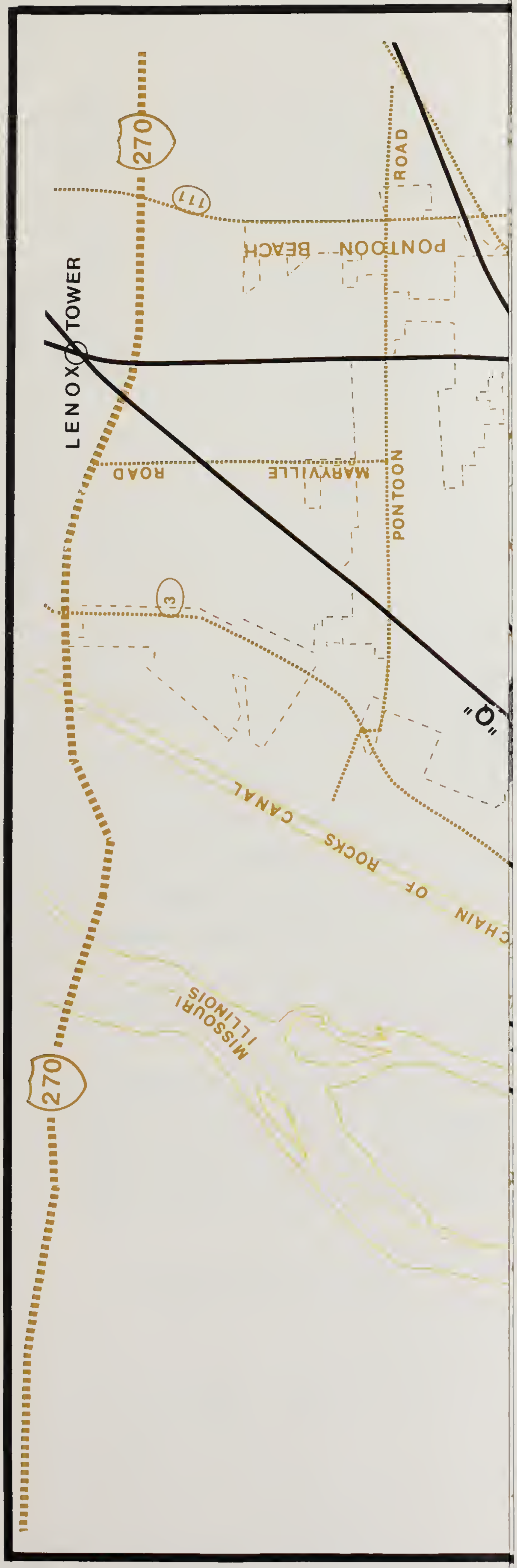


EXHIBIT A

STUDY AREA

VICINITY MAP

LEGEND

ROUTE 3 RELOCATION AREA
RAILROADS
INTERSTATES
PROPOSED RAILROAD YARD
CITY STREETS
EXISTING RAILROAD YARD

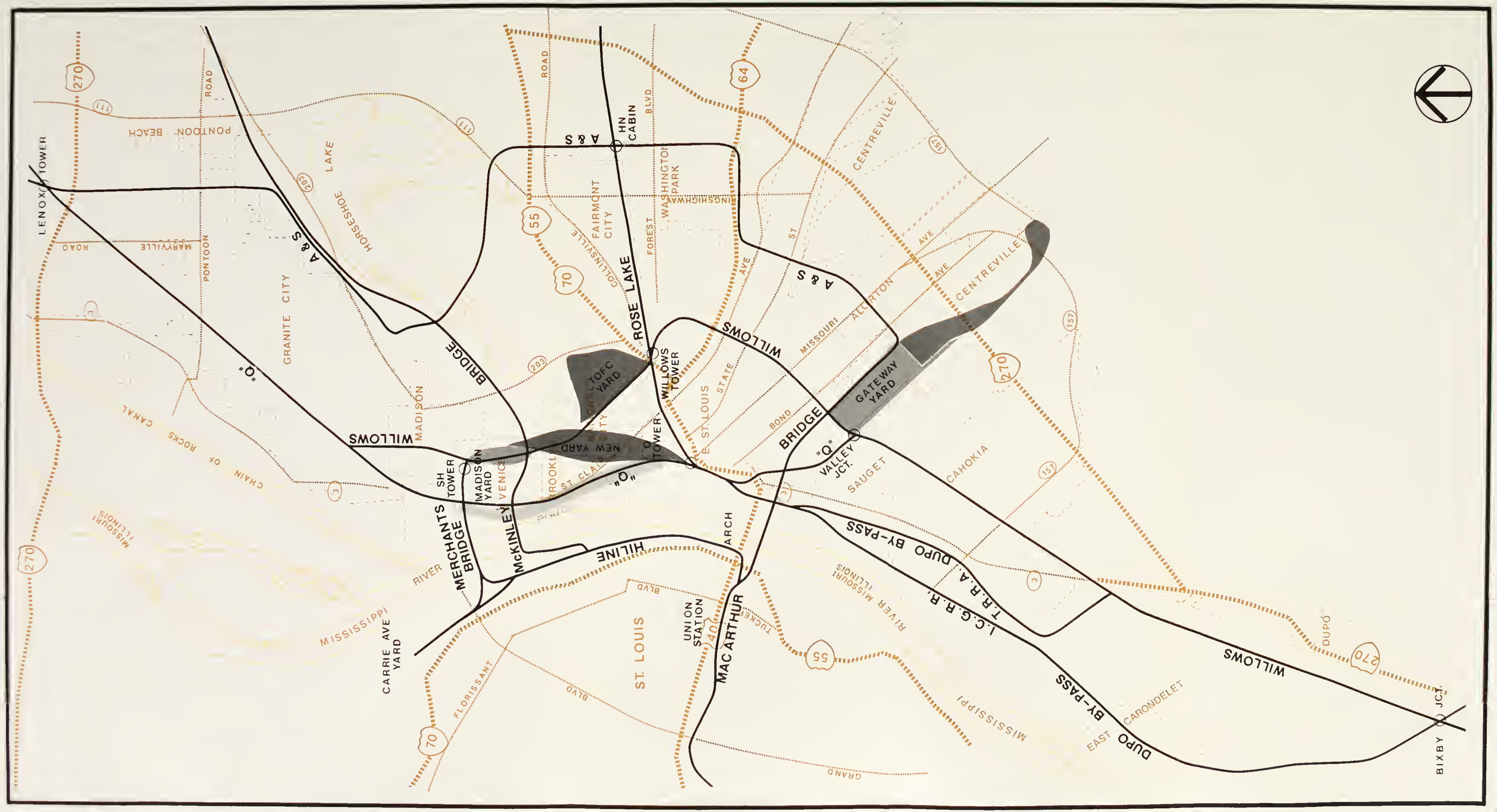
6000 3000 0 5700

SCALE IN FEET

ST. LOUIS MARGE PROJECT
SVERDRUP / ENVIRODYNE / KNIGHT

EXHIBIT A

STUDY AREA



VICINITY MAP

LEGEND

ROUTE 3 RELOCATION AREA
RAILROADS
INTERSTATES
PROPOSED RAILROAD YARD
CITY STREETS
EXISTING RAILROAD YARD

6000 3000 0 5700

SCALE IN FEET

ST. LOUIS MARGE PROJECT
SVERDRUP / ENVIRODYNE KNIGHT

Railroad freight terminals, such as the one in St. Louis, are typically bottlenecks in the operation of rail systems. Increased rail traffic and age have reduced the efficiency of terminal operations and shipments often encounter excessive delays moving through congested switching and classification facilities. Facilities built early in the development of the rail system have become obsolete, but have continued to occupy sizeable amounts of land, constraining land use patterns and forming barriers to social and commercial activity.

In the St. Louis Gateway the situation is worsened by the continued presence of yards and tracks originally built near the river to hold cars awaiting the ferry crossing. These facilities became unnecessary as bridges were built and were used less and less until, in some cases, they were virtually abandoned. As in other urban rail terminals, this has served as a blighting influence on the area's economic development. Further, underutilized railroad properties do not yield tax revenues proportional to the amount of land they cover. The complicated network of yards and track has also produced a contorted street system where delays to vehicular traffic are frequent and lengthy. This combination of problems attributable to railroad influences has lead the Federal Railroad Administration (FRA), in concert with state and local officials, to seek ways to improve rail operations and to create valuable urban development opportunities by freeing riverfront land.

St. Louis Metro Area Rail Gateway Enterprise

The efforts of the FRA toward resolving the problems of the St. Louis Gateway through railroad improvements were focused into a three phase program entitled the Metro Area Rail Gateway Enterprise or MARGE. The program focused on accomplishing the following three objectives:

- To improve the efficiency of railroad operations within the St. Louis Terminal
- To reduce rail/community conflicts
- To provide opportunities for economic and community development.

Phase I, which was successfully completed in December, 1977, was limited to the development and preliminary examination of operationally feasible physical restructuring alternatives. This initial study was jointly directed by the Federal Railroad Administration and all the 17 railroads operating in the Terminal.

Phase II, which was begun in January, 1979, is a more comprehensive study to refine the restructuring plans and resolve the various railroad institutional issues as well as the community and environmental impact issues. Phase II includes a cost/benefit analysis for each of the railroads involved, together with a comprehensive cost/benefit analysis of the railroad restructuring, and will culminate in the publication of an Environmental Impact Statement. Managed by the Illinois Department of Transportation (IDOT), under contract to the FRA, Phase II has sought active involvement by the various local communities in the Gateway area, and continued the strong railroad role of Phase I.

Phase III involves final design engineering and actual construction of improvements to the rail yards and corridors in the terminal. It begins after an alternative plan for the restructuring is selected.

Restructuring Alternatives

There are currently some 63 railyards in the St. Louis Gateway. The MARGE project proposes consolidation of many of the smaller rail yards into two or three larger yard facilities. Three "build" alternatives are fully evaluated. Each alternative differs by the number of common carrier yards and by the routing of the corridor traffic. In addition, the existing 1979 conditions and the year 2000 "No Build" alternative are analyzed and compared.

The actual yard restructuring alternatives exhibit differences in both the number of yards which would be constructed and the manner in which those yards would operate:

- Two-Yard Alternative - This plan calls for the expansion of the two existing classification yards. The Gateway Yard, located south of East St. Louis, would be expanded eastward. This area is partly within the boundaries of Centreville, Illinois and is currently agricultural and residential. The Madison Yard, which is just east of Venice, would be modified and expanded south past the residential areas of Brooklyn and National City.

- Three-Yard Directional Alternative - This plan involves the expansion of Gateway Yard, minor improvements to Madison Yard and the construction of a third yard, the "New Yard". This third yard would be located just south of Madison Yard, adjacent to the town of Brooklyn. Madison Yard would then function as an industrial support yard with the classification functions transferred to New Yard. The Directional distinction refers to the operational plan for the yards, which would have one yard handle trains coming from the East and headed West, and the other coming from the West and headed East.

- Three-Yard Bidirectional - This plan is distinguished from the above only in the operational plan of car and train routing. Each yard would route traffic in all directions. The physical configurations of the yards would be similar to the Directional Plan, except that the New Yard would be located approximately 200 feet further from the residential areas of Brooklyn, and that the expanded Gateway Yard would be constructed about 200 feet farther south from the housing areas of Centreville.

- No-Build Alternative - As a bench mark against which to analyze the "build" alternatives, a "no-build" situation has also been studied. This plan assumes that no improvements are made to the Gateway terminal. The No-Build Alternative assumes that the same traffic levels will exist in St. Louis in the Year 2000 as are projected for the Build cases. This traffic, to the extent it overtaxes the common classification yards, would be handled at individual rail yards.

Several elements of the consolidation are the same across all the "build" alternatives.

- A segment of Illinois Route 3 would be relocated in order to bypass the expanded yards. The designated section begins just north of Merchants Bridge in Madison County as four-lane highway and continues 3 miles south as a two-lane road through Venice and Brooklyn, past National City, ending at St. Clair Avenue in East St. Louis. The relocation would provide a two- or four-lane, limited-access highway for this distance.

- A common trailer-on-flatcar (TOFC) yard would be constructed east of Brooklyn and north of East St. Louis. The location is convenient to a major interchange connecting Illinois Route 203 and Interstate 70, providing excellent access for trucks. A major rail corridor runs just west of the site. Eight or nine of the thirteen Class I carriers would consolidate their TOFC, or piggyback operations into that one yard.

- There are approximately 82 miles of main line rail corridor in the project area, and much of this would be upgraded under all of the build alternatives. Track would be physically improved by laying new or replacement track and modern centralized signaling systems would be installed. Several new rail connections or interlockings would be constructed, but the locations of the corridors and existing interlockings would remain the same. Rail operations and train routings may vary across alternatives, but the basic corridor network does not.

- Seventeen-eighteen grade-separation structures are warranted under all the build alternatives, due to the large delay- and collision-related conflicts which occur in the project area. Seven of these would be warranted because of yard expansions; the remainder are warranted due to conflicts along the rail corridors. Nine of these structures would also be warranted under the No-Build Alternative.

The only significant physical differences among the Build Alternatives were in the treatment of Madison Yard. Under the Two-Yard Directional Alternative, Gateway Yard and Madison Yard would be expanded (approximately 125% and 75%, respectively, in terms of standing track capacity); while under both Three-Yard Alternatives, Gateway Yard would be expanded, Madison Yard would remain unchanged, and a New Yard (a dual hump facility approximately twice as large as existing Madison Yard) would be constructed south of Madison Yard. These physical differences are summarized in Table I, While Table II presents the year 2000 daily common yard traffic loads projected under each alternative.

TABLE I

STANDING CAR CAPACITY OF MAJOR YARDS

ALTERNATIVE	YARD TRACK			
	RECEIVING	CLASSIFICATION	DEPARTURE	TOTAL
NO BUILD				
CAR CAPACITY	1,590	3,697	2,179	7,520
TWO-YARD DIRECTIONAL				
CAR CAPACITY	4,808	4,798	5,818	15,424
INCREASE VS. NO BUILD				
NUMBER	3,164	1,101	3,639	7,904
PERCENT	192	30	167	105
THREE-YARD DIRECTIONAL				
CAR CAPACITY	6,590	7,248	7,684	21,522
INCREASE VS. NO BUILD				
NUMBER	4,946	3,551	5,505	14,002
PERCENT	301	96	253	186
THREE-YARD BIDIRECTIONAL				
CAR CAPACITY	4,775	7,248	6,008	18,031
INCREASE VS. NO BUILD				
NUMBER	3,131	3,551	3,829	10,511
PERCENT	190	96	176	140

TABLE II

DAILY COMMON YARD TRAFFIC LOADS - YEAR 2000

ALTERNATIVE	INBOUND TRAINS	OUTBOUND TRAINS	CARS TO SWITCH
NO BUILD			
NUMBER	55	68	4,020
TWO-YARD DIRECTIONAL			
NUMBER	77	100	6,565
INCREASE VS. NO BUILD			
NUMBER	22	32	2,545
PERCENT	40	47	63
THREE-YARD DIRECTIONAL			
NUMBER	110	126	8,434
INCREASE VS. NO BUILD			
NUMBER	55	58	4,414
PERCENT	100	85	110
THREE-YARD BIDIRECTIONAL			
NUMBER	102	112	7,552
INCREASE VS. NO BUILD			
NUMBER	47	44	3,532
PERCENT	85	65	88

PHASE II STUDY BACKGROUND AND INTENT

Much of the groundwork for the development of this Phase II study was laid in St. Louis Railroad Gateway Terminal Restructuring Project - Phase I (Report FRA/OPPD-78-6). The objective of the Phase I Study was to develop alternative restructuring plans that were physically and operationally feasible and acceptable to the railroads. In this sense, the goal of improving railroad efficiency defined the set of feasible restructuring alternatives within which the other project goals could be realized. In the Phase I Study, potential restructuring alternatives were examined in a broad manner with operational, cost and engineering analyses performed only in orders of magnitude.

In Phase II, detailed analyses were performed on the engineering design of the physical facilities, on the rail operating strategies, and on operating cost factors. Studies were conducted to determine community, economic and environmental impacts related to the restructuring plan alternatives. Based on these analyses, the conceptual restructuring plans were further refined and studies performed to provide evaluations of the overall efficiency of the various plans. The end result of Phase II of the restructuring effort will be the selection of a specific alternative for the restructuring of physical facilities and operations in the St. Louis terminal area.

After the choice of a preferred alternative is made, the third and final phase of restructuring can commence. Phase III would encompass the detailed engineering design work, construction activity and other facets of implementation.

The goal of improving railroad efficiency within the St. Louis terminal area was the focus of CONSAD Research Corporation's involvement in this Phase III Study. CONSAD's role has been to perform detailed and comprehensive operational and cost analyses of restructuring alternatives for the St. Louis terminal area. The purposes of these analyses were:

- To furnish information important to refining the design of specific physical facilities and operating strategies under various restructuring alternatives

- To provide comprehensive operating and cost data for each alternative in two future years (1985 and 2000), and for use in the developing measures of operational efficiency and cost-effectiveness of alternative restructuring plans.

These measures of railroad operational efficiency and cost-effectiveness are the principal results of CONSAD's work. They serve as the base for evaluating how well each of the alternatives fulfills the goal of improving railroad efficiency.

Decision makers must also weigh factors other than improved railroad efficiency, which are dealt with separately in the other analyses performed in Phase II and documented in the MARGE Environmental Impact Statement.

STUDY AREA DEFINITION

The study area was defined as spanning the Mississippi River and incorporates portions of the States of Illinois and Missouri. The physical boundaries of the study area are: the MKT (see Table III for a list of railroads involved and their name abbreviations) Baden Yard on the north; Bixby Junction (ICG-MP crossing) on the south; the junctions of the A&S mainline with several line-haul carriers on the east and northeast; and the TRRA Carrie Avenue and SLSF-MP-TRRA-NW Grand Avenue Yards on the west. All operations falling within these boundaries were generally considered to be within the study area.

This study area (also referred to as the Terminal Area and the Gateway Area) presents an exceedingly varied and complex system. It is composed of approximately 25 important switching facilties (two of which are major common classification yards), nearly 100 route-miles of corridor network (most of which is double and triple tracked) along with numerous railroad interlockings and connections. There are 17 major linehaul, terminal and switching railroad companies operating within and through the study area, as shown in Table III.

TABLE III
RAILROADS OPERATING
IN THE ST. LOUIS GATEWAY

Alton and Southern (A&S)	Manufacturers (MRS)
Baltimore and Ohio (B&O)	Missouri-Kansas-Texas (MKT)
Burlington Northern (BN)	Missouri Pacific (MP)
Chicago and Northwestern (CNW)	Norfolk and Western (N&W)
Chicago Rock Island and Pacific*(CRIP)	St. Louis-San Francisco (SLSF)
Conrail (CR)	St. Louis Southwestern (SSW)
Illinois Central Gulf (ICG)	Southern (SOU)
Terminal Railroad Association of St. Louis (TRRA)	Illinois Terminal (IT)
Louisville and Nashville (L&N)	

* Ceased operations March, 1980 - St. Louis properties mostly acquired by SSW. It should also be noted that several other railroads have been or are currently involved in mergers and/or acquisitions. In general, these changes have few operational impacts in the study area, and the railroads have been treated as separate operating entities, as listed above.

Within these geographic boundaries, the scope of the analysis varied in level of detail and amount of data collected for analysis. Operations that were common to more than one railroad, such as joint or multi-carrier yards (Gateway, Madison, New Yard) were examined in minute detail. Yards falling within the geographic study area, but operated by and for a single linehaul carrier, were grouped in a category called "home yards" and studied only to the extent their function affected either rail operations in the common yards, or the freeing of rail-occupied land for redevelopment.

Similarly, corridors used by only one or two carriers in approximately the same way under all restructuring alternatives, and seen as having no major role in restructuring corridor operations, were considered less stringently. Corridors that fed the major common switching facilities were studied in detail, with upgrading often being considered. The operation of a joint Trailer/Container-on-Flatcar (TOFC/COFC) facility was also subjected to careful study; on the other hand, the operation of individual TOFC facilities by carriers who did not indicate a desire to participate in the common facility was examined less intensely.

DATA BASE AND STUDY PARAMETERS

Study Parameters:

To begin the study, the following parameters were established, with RTAC and IDOT guidance:

- The basic horizon year for planning was chosen to be 2000. At the request of RTAC, CONSAD agreed to also examine operations in the Year 1985 so that a shorter term picture would be clear to all participants. It was understood that the physical restructuring proposed could not be completed by the Year 1985, and that the Environmental Impact Statement would address itself to Year 2000 conditions only

- In order to determine the growth (or decline) that traffic through the study area might experience between the 1979 data base year and the 1985 and 2000 horizon years, each railroad was asked to furnish growth projections for three classes of traffic: unit trains (primarily, but not exclusively, coal), TOFC/COFC, and general merchandise

- The data base used in Phase I was deemed to be inadequate for the purposes of the Phase II Study. The individual railroads' RTAC representatives indicated that historical data in the form requested was virtually unattainable in machine readable form. The result was the selection of Friday, March 30, 1979 as the data base day. The date proved to be as close to ideal for the purposes of this study as could be imagined. While no day is necessarily representative for all roads, the day was found to be heavy, with relatively few random interruptions (derailments, etc.)

- A Common TOFC/COFC intermodal facility had been examined in Phase I at a relatively low level of detail. The implication of this was recognized and CONSAD collected detailed field data on intermodal operations immediately after the March 30, 1979 study date to allow the preparation of the best analysis possible of this sensitive area

- The three major measures of effectiveness to be employed in evaluating the alternatives from a rail operations viewpoint were rail car transit time through the Gateway, the reliability of rail operations and the cost of rail operations.

Data Base:

The collection of adequate data concerning traffic moving through and within the study area was, in itself, a large, complex effort. In order to fully specify all traffic moving in thestudy area on the study day, CONSAD requested that each railroad provide train consists, interchange reports, tower interlocking sheets, and train dispatchers' records for that day. Subsequently, each RTAC member was contacted to review the data and to supplement it with other required information. Approximately 500 trains were identified as having moved on March 30, 1979. A basic inventory of trains was created, showing:

- Railroad company operating the train, with train symbol
- Engine numbers and tractive effort of engines
- Caboose number
- Entry point in the study area, and time entered
- Number of cars (loaded and empty)
- Tonnage of train
- Blocks on train and number of cars in each block
- Route taken in study area, and destination road/yard/industry
- Crew change requirements
- Exit point from the study area, and time exited.

In order to relate this information on train movements to car movements, the Association of American Railroads (AAR) Labor Management Task Force data base was utilized. The Task Force, in conjunction with the AAR, collects car movement data from most of the linehaul carriers in the St. Louis area. This data covers every movement of a car from the point at which it enters the study area to the point at which it exits. Access to the data base was acquired through the AAR with the permission of each railroad. Full documentation of the data base was obtained from AAR systems personnel.

Since it was necessary to trace the movement of each car in the study area on March 30, it was decided to examine data from at least four days on either side of March 30 to assure that the complete movement was traced (e.g., a car that was on an outbound train on March 30, probably came into the study area on March 26, 27, or 28 and, hence, car data for these days had to be examined to get a full trace on that car).

Existing Conditions:

The inventory of existing conditions in the terminal area showed that approximately 9,000 cars per day move within and through the study area, nearly 7,000 (77%) of which are handled or switched. These cars are often handled at a low level of operational and cost efficiency. Because of the complex and redundant nature of the physical system and the fragmented institutional arrangements, many cars are handled several times by different operating entities in different facilities (see Table IV). These additional handlings often lead to increased congestion and delay, decreased reliability of operations and high operating costs to the railroads. As traffic moving within and through the study area continues to increase, these types of problems will most likely intensify; and although the terminal may continue to function, per se, it will not operate at a level of efficiency which is beneficial to the railroad industry, in particular, or to the national transportation system, in general.

Table V presents a summary of the current and projected volumes and make-up of railroad traffic entering the study area on a dialy basis. This exhibit shows that, by the Year 2000, nearly 17,000 cars per day will enter the study area, an increase of nearly 8,000 cars, or 88 percent, over 1979 traffic levels. Also, it may be seen that the daily number of cars to be switched or handled within the study area will increase by 4,000 cars (59 percent) over 1979 levels of approximately 11,000 cars per day.

TABLE IV

CAR HANDLING 1979

	1979 No Build
Cars in through or unit trains	2,070 (23%)
Cars to be handled*	
with no transfers	1,585 (18%)
with 1 transfers	3,269 (36%)
with 2 transfers	1,683 (19%)
with 3 transfers	393 (4%)
Subtotal - cars handled	6,930 (77%)
Total Cars	9,000 (100%)
Total Car Handlings*	14,774

* Note:
Car in thru train = 0 car handlings;
Car handled with no transfers = 1 car handling;
Car handled with 1 transfer = 2 car handlings;
Car handled with 2 transfers = 3 car handlings; and
Car handled with 3 transfers = 4 car handlings.

TABLE V

CARS ENTERING THE STUDY AREA IN ONE DAY

	1979		1985		2000	
	# of Cars	% of Total	# of Cars	% of Total	# of Cars	% of Total
In Through Trains	590	7	600	6	1,070	6
% Increase Over 1979			+12		+81	
In Unit Trains	1,480	16	2,030	19	4,870	29
% Increase Over 1979			+37		+229	
Subtotal (not switched)	2,070	23	2,690	25	5,940	35
% Increase Over 1979			+30		+187	
In Trains To/From Local Ind.	970	11	1,130	10	1,650	10
% Increase Over 1979			+16		+70	
In Trains to be Handled and Forwarded	5,960	66	6,790	63	9,370	55
% Increase Over 1979			+14		+57	
Subtotal (Switched)	6,930	77	7,920	73	11,020	65
% Increase Over 1979			+14		+59	
TOTAL	9,000	100	10,610	100	16,960	100
% Increase Over 1979			+18		+88	

The two major existing classification yards in the study area are the TRRA Madison Yard and the A&S Gateway Yard. TRRA Madison Yard is a side-by-side single hump facility that also serves as an industrial support yard. The major industry supported directly from Madison is the National Steel Corporation's Granite City Steel complex, consisting of mill and blast furnace divisions. The nature of the steel business requires that the railroad serving the complex hold various accumulations of cars for the steel company, for example, coal, coke, iron ore, and empty finished steel cars. These accumulations can exceed 400 cars at any one time. The other types of industrial activity supported from Madison Yard includes fertilizer and scrap dealers, railroad cross tie treatment, and metal processing. Each of these industrial activities can, from time to time, generate substantial backlogs of inbound cars. Thus, Madison Yard and the surrounding supporting or sub-yards (Carworks Yard, Hookey Yard, Freight Mains, and Eastern Connections Yard) function not only as train and interchange yards, but as important industrial support and holding facilities.

The hump operation at Madison Yard commenced in 1975. Prior to that time, Madison was a large flat switching yard. As presently operated, Madison Yard consists of 11 receiving tracks, 3 receiving/departure tracks, 26 departure/industrial tracks, and 40 bowl tracks. There is a single lead over the hump on the north end of the yard, connected to two parallel hump approach leads which lead to the Merchants Bridge. The approach to the Merchants Bridge must be used when humping cuts greater than approximately 50 cars in length, a practice which has often led to congestion of bridge traffic. There are two pullout leads on the south end of the yard, running through a complex called CP Junction, which is the crossing of two lines of the IT (used by CNW and ICG as well as IT) and one line of N&W (currently out of service) with the junction of four lines of the TRRA (SH Tower-CP; CP-Willows Tower; CP-Bridge Junction/CD Yard; and CP-Wiggins Yard).

A&S Gateway Yard is a folded, in-line douple hump operation. The hump operation commenced in the early 1960's, with the second hump placed in operation in the early 1970's. The receiving yard of 16 tracks lies on the north side of the yard, connected by two curved leads to the dual hump. The bowl contains 54 tracks, which are connected to the 12

The receiving yard of 16 tracks lies on the north side of the yard, connected by two curved leads to the dual hump. The bowl contains 54 tracks, which are connected to the 12 departure tracks by four pullout leads. Seven of the departure tracks are effectively continuations of the pullout leads, while the other five are parallel to the bowl, reached in a pull-shove operation.

The major function performed is the receipt, classification and dispatch of road trains of several linehaul carriers (including the interchange of cars), and the similar receipt and dispatch of transfers. There is also a modest amount of industrial activity supported from Gateway, using the facilities described above.

The corridors of TRRA and A&S are generally "yard limit" operations (20 MPH maximum speed) supervised by dispatchers and yardmasters, who primarily control trains by use of radio, telephone, and instructions to operators of manned interlocking towers and junctions. Most of these corridors have a relatively high density of street crossings at-grade with the railroads.

These are no common or joint TOFC/COFC facilities in the study area. Each linehaul carrier in the study area operates at least one TOFC/COFC facility, except the Illinois Terminal, which does not now participate in TOFC/COFC business as an originating or terminating carrier. Interchange of TOFC traffic between carriers is generally accomplished by rubber interchange, that is, the trailer is grounded at the inbound carrier's facility, hauled to the outbound carrier's facility by a truck (tractor), and loaded on another flatcar for further movement.

OPERATIONS ANALYSIS METHODS

Introduction:

The initial focus of CONSAD's work was an analysis of railroad operations within the study area, both as they are at the present time and as they would be in the future under any one of the four proposed alternatives for the restructuring of the physical facilities and operating patterns in the area. The purposes of these operations analyses were:

- To furnish information useful in the refinement of the design of specific physical facilities (i.e., common yards and the corridor network) under the various restructuring alternatives

- To provide comprehensive operating data, concerned with railroad operations under these restructuring alternatives in two future years (1985 and 2000), once the detailed physical characteristics of the various restructuring alternatives were established, which would be employed in the development of measures of operational- and cost-effectiveness of the alternative restructuring plans.

The operations in and around a large metropolitan railroad study area, such as St. Louis/East St. Louis, are varied and exceedingly complex, and it was not feasible to perform a detailed analysis of operations for such a system as a single entity. Because of this railroad operations were analyzed from the standpoint of the major operational components of the system, which were the corridor network, the classification yards, and the intermodal facilities. The results of these detailed component or subsystem analyses were then summarized and merged to produce measures of the relative effectiveness of the system as a whole under each of the proposed restructuring alternatives .

Yard Operations:

In order to develop detailed operating data for the proposed yard facilities under future traffic loads, it was necessary to simulate the operations of these yards. Given the unique sets of projected conditions under which they would be required to function, the complexity of yard operations, and the fact that a large number of restructuring alternative/yard/year combinations were to be analyzed, it was determined that these simulations would necessitate the use of computer modelling

techniques. Therefore, the first task in the analysis of yard operations was the selection of an appropriate classification yard simulation model. Several computer models for the simulation of hump classification yards were examined, leading to the selection of the Conrail Classification Yard Simulation Model, which was an updated version of a model developed for the United States Railway Association.

Conrail's Classification Yard Simulation Model was developed for them by Boeing Computer Services Company and was adapted for use in the restructuring study by CONSAD and staff of the Illinois Department of Transportation. The model provides a detailed representation of everyday hump yard operations and served as a valuable tool in the analysis, design and planning of the involved rail yards. In addition to generating data concerned with the nature and efficiency of movements of rail traffic through the yards under study, the model output furnished information useful for the environmental impact analyses and for operations costing of the various restructuring alternatives.

The Conrail Yard Model is an event based simulation and was developed primarily to assist in the determination of the following factors concerning classification yard operations:

- Maximum traffic capacity of the particular yard given specified resources and work rates
- Effect of variations in the levels of mobile resources (i.e., hump and trim engines, inspection crews, etc.)
- Impact of changes in fixed facilities (i.e., number and capacity of receiving, classification and departure tracks, number of hump leads, the addition or deletion of crossover switches in the pullout area, etc.)
- The movement of specific groups of cars through the yard under various sets of circumstances as described above.

Therefore, once a base case has been established, the model allows for the evaluation of the comparative advantages and/or disadvantages of different options with respect to the physical configuration and operating policies of a particular railroad.

From the simulation process, the model tabulates a great deal of detailed operating data and generates several summary reports as a part of its output. These include Track, Hump, and Crew Utilization Reports, as well as a number of other reports useful in identifying very specific yard problems. Finally, General Yard Performance Summaries are output, featuring a frequency distribution of cars transiting the given yard and specifying the time taken for each element of yarding.

Corridor Simulation and Analysis:

Within the terminal area, the majority of train movements are supervised by two train dispatchers located at SH Tower on the TRRA, and by an Assistant General Yardmaster at Gateway Yard on the A&S. One of the two dispatchers at SH controls movements between WR Tower and Gratiot Street Tower, and between SH Tower and CP Junction. The other dispatcher at SH controls trains between CP Junction and Valley Junction, and between May Street and Rock Island Junction, an area not being studied in detail. The A&S Assistant General Yardmaster at Gateway Yard functions much in the same manner as a train dispatcher, and controls corridor movement between Lenox and Tolson on the A&S. The other segments of the study area are either:

- Under the control of a dispatcher at some other location (e.g., Conrail at Indianapolis for the segments Lenox-WR-Bridge Junction and Exermont-Q Tower on Conrail, and Washington, Indiana for the segment Caseyville-Q Tower on B&O

- Under the supervision of a train director (e.g., TRRA Tower 2 for movements between Gratiot Street Tower and Grand Avenue, the City of St. Louis MacArthur Bridge Commission at Gratiot Street Tower for movements on the MacArthur Bridge).

There are several interlocking towers within the area, with movements within and proximate to the interlocking under the supervision of the interlocking control operator. These operators use the interlocking to move trains on one or more corridors in accordance with the appropriate dispatcher's instructions, and attempt to minimize delay and conflicts at the interlocking. Also within the study area are several yards, where trains originate and terminate, and non-interlocked junctions.

In order to analyze the operation of trains and evaluate the selected corridors at projected levels of traffic under each proposed restructuring alternative, it was decided to simulate the interaction among the various operators and the three primary dispatchers. This simulation allowed the performance of each train to be documented, including the identification of conflicts at the various interlockings, junctions, and yards.

The first step in this simulation process was to subdivide the terminal study area into logical sub-parts. As in the "real world", in the simulation process the "dispatcher" supervised the movement of trains on main tracks between interlockings, junctions, and yards. The next step in this process was to compile a list of trains to be analyzed in the study from the traffic data, and to create an appropriate list of running times by class of train, by track, and by direction, for trains among the various interlockings, junctions, and yards. Schematics for each interlocking, junction, and yard entrance and exit, and recording forms (such as train sheets and station log sheets) for use by each individual involved in the simulation process were created.

When a day of activity was replicated, a series of tables were completed. The purpose of these tables was to provide an orderly, systematic, logical analysis of the train operation, highlighting delays and excessive running times.

After the results of this process were presented to the RTAC, several changes in corridor operations were suggested. The most effective way of dealing with these changes was to create time-distance (or time-space) graphs, commonly called stringlines. Each axis is scaled, with the vertical axis of the stringline representing distance, showing significant features of each corridor, such as stations, crossovers, railroad crossings, and junctions. The horizontal axis of each stringline is scaled as time.

Diagonal lines indicate trains, with the slope indicative of speed and delays shown by "flat" (horizontal) lines. A separate stringline was created for each corridor, and each train was drawn in. Changes were then made to the stringlines as changes were made in corridor operations. The conflicts caused by changes were readily apparent. After all changes had been made, the times were taken off the stringlines and matched with train data already in the operations analysis computer files. This allowed the generation of a myriad of corridor statistics, assisting in refining designs and developing operations costs and impact assessments.

TOFC Operations:

The restructuring of physical facilities and operational patterns proposed in the Phase I Study included a plan for the establishment and operation of a common intermodal terminal. The impetus for the development of this facility was twofold. First, some roads would be scaling down or completely abandoning their "home yard" facilities and need an alternative location for intermodal operation. Second, current high service levels demand over-the-road interchange of intermodal traffic, an operation which is acknowledged to be both inefficient and extremely expensive.

Nine of the fourteen line-haul railroads with operations in the study area have indicated a desire to participate in this type of facility (BO, CNW, CR, CRIP, ICG, IT, LN, MKT, and MP). These nine roads accounted for approximately 67% of all study area intermodal freight handlings in 1979 and are projected to account for 72% of the intermodal traffic in the Year 2000.

The proposed terminal facility is to function as:

- a loading/unloading point for all local industry traffic
- a classification yard to effect interchange among participating roads and between the participating roads and non-participating roads

- an outbound train yard to build outbound TOFC/COFC blocks for solid intermodal trains and for trains departing other classification yards with other traffic

- a storage facility for trailers and flatcars. Given this, and information supplied by CONSAD on the volume and type of intermodal traffic that potentially would be handled by the facility, SEK devised an initial design for the common TOFC/COFC terminal.

Summary:

The results of these analyses of yards, corridors, and yard hold-outs were then merged into the overall operations analyses through the use of the previously mentioned "stringlining" technique. Since the specific corridor, route, and yard for each inbound and outbound train was known, the impacts of specific operations problems could be assessed. Also, the impacts of changes in operations due to redesign of yards and corridors could be cascaded throughout the entire network to determine the effects on the performance of the entire system.

COST-EFFECTIVENESS ANALYSIS

Introduction:

In evaluating the performance of the proposed alternatives for the operation of the rail facilities in the study area, three basic measures of performance were selected: operations cost, car transit time through the Gateway, and reliability. The measurement and evaluation of each of these measures has been performed independently, in spite of the fact that each is related to the others. The reason for this is twofold: first, the relationships between the various indicators is indirect, and second, the importance of each indicator varies with the perception of the viewer.

Reliability:

The four project alternatives, due to the unique set of operational strategies embodied in each, should have somewhat different levels of operational reliability associated with them. Therefore, in order to be able to fully evaluate the performance of alternative restructuring plans relative to one another, it was necessary to develop some measure(s) of the reliability of railroad operations under each restructuring plan.

Reliability in railroad operations has been previously addresed in a series of studies conducted at the Massachusetts Institute of Technology (MIT) in the early 1970's. In that work, various ways of defining reliability were considered, all of which related to "Compactness" (lack of spread) of trip time. The MIT research also dealt with the events or conditions which lead to unreliability. While the St. Louis restructuring study was different in several respects from the railroad operations analyzed by MIT, some of the principles for measuring reliability were adaptable to the St. Louis Study. In particular, CONSAD determined that "number of times handled", "schedule slack" (as a measure of MIT's "available yard time"), and "missed connections" were the essential aspects of service reliability that could and should be addressed.

The MIT work showed that the most frequent cause of unreliable service was the failure of the car to operate on the outbound train, either because of a block being left off an outbound train, or an outbound train not being run, and the second most frequent reason was late arrivals of inbound trains.

Generally, outbound trains from the study area generally failed to operate one day per week or 14.3 percent of the time. For the purpose of this evaluation of reliability, it was assumed that the behavior of inbound trains would not differ among the various alternatives. Since the requirement that each road haul carrier has to balance engines, cabooses, and crews is seen as the overriding criterion, the behavior of outbound trains was also assumed to hold constant.

Thus, the reliability that is associated with each alternative is strictly the reliability of the facilities and their operation. The key aspect is missed connections, the number and percent of cars which moved through the study area and exited on other than their "scheduled" connections. (Missed connections included both early and late departures. Early departure is probably not as undesirable as late departure inasmuch as this may provide slack which could guarantee connections at subsequent yards. However, given fixed levels of resources, early departure may cause other traffic to move late. Thus, both early and late departures from the study area may be undesirable.)

Whenever a rail car is switched (or handled) there are several opportunities for things to go wrong. The car can be bad ordered, no-billed, or misswitched, all of which result in delay. Thus, one indirect measure of reliability by which the operating plans could be compared is the number of times cars were switched in the study. The total number of car handlings and the average handlings per car, under each alternative, were determined from the operations analysis, and are provided in Table VI. Each transfer movement represents an additional handling of a car, with each additional handling carrying with it the potential for misssed connections.

TABLE VI

Car Handling* Under Restructuring Alternatives

		2000		
	No-Build	Two-Yard Directional	Three-Yard Directional	Three-Yard Bidirectional
Cars in through or unit trains	5940 (35%)	5940 (35%)	5940 (35%)	5940 (35%)
Cars to be handled				
with no transfers	2520 (15%)	4707 (28%)	5577 (33%)	6581 (39%)
with 1 transfer	5199 (31%)	5644 (33%)	4194 (25%)	4417 (26%)
with 2 transfers	2677 (16%)	625 (4%)	1137 (7%)	0 (0%)
with 3 transfers	624 (4%)	44 (0%)	112 (1%)	22 (0%)
Subtotal - Cars Handled	11020 (65%)	11020 (65%)	11020 (65%)	11020 (65%)
Total Cars	16960 (100%)	16960 (100%)	16960 (100%)	16960 (100%)
Total Car Handlings	23445	18046	17824	15503
Reduction in Total Car Handlings Compared to No-Build	NA	-23%	-24%	-34%

* Note:

Car in through train = 0 car handlings
car handled with no transfers = 1 car handling
car handled with 1 transfer = 2 car handlings
car handled with 2 transfers = 3 car handlings
car handled with 3 transfers = 4 car handlings

In accumulating and analyzing the traffic data for the Phase II study, it was determined that 2.5 percent of the cars passing through the common yards were bad ordered so as to need spotting on a repair track, and that 1.0 percent of the cars were placed on the hold tracks due to improper, or lost, waybill information. From discussions with terminal area operating personnel it has been determined that approximately 1.0 percent of the cars switched are switched into the wrong track, due to human error. This leads to the conclusion that there is a 4.5 percent chance of some error in each switching or car handling in the terminal area. A switching error of the type mentioned here was almost certain to cause a car to miss its scheduled connection and thus, it was assumed that there was an equivalent 4.5 percent probability of a missed connection associated with each switching or handling.

Given the above information, the probability that any car would make its scheduled connection in any facility was 81.8 percent (95.5% probability of no switching error <u>times</u> the 85.7% probability of the outbound train operating, since these are independent events). Thus, every time a car was handled it had an 81.8 percent probability of missing its scheduled connection. Knowing the number of handlings involved, it was possible to determine the percentage of cars in each Origin-Destination (OD) Pair that would move through the system without missing a connection.

Weighted average statistics for a sample of those OD Pairs, under each alternative, were calculated and applied to the total traffic volumes which they represented to yield estimates of the number of cars not meeting their schedules, given the assumptions implicit in this analysis. These estimates have been summarized and are presented in the Results Section of this report in Table VII.

TABLE VII

SUMMARY OF PERFORMANCE BY ALTERNATIVE

	Alternatives in the Year 2000			
	No-Build	Two-Yard Directional	Three-Yard Directional	Three-Yard Bidirectional
Annual Cars Handled	4,579,200	4,579,200	4,579,200	4,579,200
Annual Operating Cost ($millions)	379.36	251.31	245.33	223.82
Per Car Operating Cost ($)	82.14	54.88	53.57	48.88
Average Transit Time (hours)	46	36	33	29
Reliability				
Percent Cars Meeting Schedule	78	82	82	84
Car Handlings per car Switched	2.13	1.64	1.62	1.41
Total Car Handlings	23,445	18,046	17,824	15,503
Average Corridor Speeds (MPH)	6.6*	22.7	20.1	21.4

Notes:
* The average corridor speed in 1979 was 7.6 miles per hour.

Throughout the preceeding analyses of reliability, it has been assumed that all trains inbound to a yard arrive per their *de facto* schedules. However, examination of the operations data collected showed that inbound trains to the study area arrived within a range of seven hours ahead to eight hours after their *de facto* schedule. If an inbound train or transfer arrives at a yard late, the cars on that train may or may not be able to make their scheduled connections, depending on two factors:

- The average minimum processing time for cars moving through the particular yard
- The scheduled yard time for the cars (the time interval between the scheduled arrival at and departure from the yard).

If average minimum processing time at a yard is subtracted from the average scheduled yard time, the difference is the average amount of slack time available to a car in that yard. Theoretically this slack time would be an approximation of the maximum amount of time that the average inbound car could be late and still possibly make its schedule connection at the yard. Although this is not a measure of reliability *per se*, it does provide a rough estimate of a yard's average ability to absorb inbound lateness. Based on the average yard detention time estimates resulting from the yard operations analyses, the average minimum processing and average slack time were calculated for each alternative/yard/year combination analyzed and used to factor the consideration of slack time into the calculation of missed connections.

Transit Time:

Transit time is defined, for the purpose of this analysis, as the elapsed time between the entry of a car into the study area (or movement from a local industry) and the exit of the same car from the study area (or delivery to a local industry).

CONSAD has performed simulations of train movements and, in turn, traffic flows throughout the St. Louis Gateway. This has involved separate but interrelated simulation of the three common yards and of the 35 segments which comprise the study area corridor system. One set of specifications of the system was the set of arrival and departure times for inbound and outbound road trains, transfers, and local industrial service. This *de facto* train schedule has been carefully interrelated between yard and corridor simulations. In addition, the sample of OD Pairs was also used in the determination of transit time, tracing the movement of traffic through the study area in its entirety.

Since delays may also occur in the normal process of classification, another measure of reliability is the effect of missed connections on the transit time of cars through the study area. Not all cars are detained in a classification yard the same amount of time; rather, there is a distribution of detention times. For example, some cars which arrived at the yard later than others of the same outbound classification (or which required a longer time to process in the receiving yard) are more likely to arrive in the bowl after the pull time for that outbound classification and would be left behind to connect with the next later outbound train carrying that classification. The results of these calculations are also shown in the Results Section of this Report.

Operations Cost Analysis:

One of the critical determinations required for the evaluation of alternative restructuring plans for the St. Louis Railroad Gateway was the cost of operations that would be incurred by the railroads involved, under each alternative, and the relationship of those operating costs to the capital costs of implementing each plan. In this section of the report, the methodologies employed in the determination of operation costs for each of the operational components of the study area (i.e., yards, corridors, intermodal facilities, transfers, and home road operations) are described. The final portions of this section deal with

the development of system costs for each restructuring alternative and the allocation and/or attribution of these costs to the various railroads associated with the restructuring effort. A detailed discussion of the methodology and unit costs derived is included in the second volume this Technical Supplement to the Draft EIS, the Rail Operations Analysis

The general approach ultimately followed in the costing of operations for any one of the individual operational components was the one which best met criteria of reliability, consistency, and data availability with regard to that component and the nature of its operations.

The different methodologies employed for the estimation of operating costs are described below. However, it should be noted that, while the approaches taken in cost estimation for the various operating components may differ somewhat, the operating costs determined as a result of these methodologies are similar to two very important respects. There are:

- Throughout the analyses, costs were determined for each of the same six major railroad activity/cost accounts (Maintenance of Way, Maintenance of Equipment, Transportation, General and Administrative, Equipment Capital, and Car Costs)
- All costs were estimated in constant 1979 dollars.

These two similarities made it possible to aggregate individual operating component costs (yards, corridors, etc.) to yield uniform system costs, and to allow meaningful comparisons between the operating costs estimated for various restructuring alternatives and years to be made.

Yard Operations Costing:

The general approach followed in the costing of operations of the common railroad yards involved in the study was to develop actual Class II carrier costs for the two major terminal and switching companies operating within the St. Louis Gateway, namely the Terminal Railroad

Association of St. Louis (TRRA) and the Alton and Southern Railway Company (A&S). The primary reasons for taking this approach were the following:

- These Class II carriers operate the major existing commmon yard facilities within the study area
- The majority of the proposed yard facilities would be expansions of the existing facilities operated by these carriers with the exception of New Yard
- The scope of operations of these carriers is limited to the St. Louis area, with its specific geographic climate and railroad operational characteristics
- The existance of historical cost data which were relatively uniform, reliable and readily available in the form of Annual Reports (Form R-2, required to be submitted by these carriers to the ICC).

The only major drawback in using this approach was that the cost data provided in the R-2 Reports are not exceedingly detailed. However, through the use of date from other published sources and additional data supplied by the carriers, it was possible to develop cost data of a sufficient level of detail and accuracy for use in this study.

Corridor Operations Costing:

The development of system costs by Class I railroads was the general approach selected for use in the estimation of corridor operating costs for the various restructuring alternatives. These system costs are required to be submitted by all Class I railroads to the ICC on an annual basis and in a uniform system of accounts. Also, the railroads are required to report annual operating statistics (train-miles, train-hours, etc.) related to these costs.

The major criteria for the selection of a cost data source were reliability of cost factors and operating statistics, uniformly in accounting procedures, and availability of data. This approach satisfied these three criteria; permitted data to be accumulated in a reasonable period of time; allowed historical cost analysis; and was readily applicable to the St. Louis project.

TOFC Operations Costing:

The general approach followed in the estimation of operating costs for the proposed common intermodal (TOFC) facility was that of zero-based costing. The primary reasons for pursuing this approach were:

- No large common facility of this type, that could be used as a model for cost estimation, exists in the U.S.
- Relatively little published data concerning railroad TOFC operations and costs is available
- Due to the tremendous diversity of TOFC operation and the significant differences in costs associated with these operations, the development of cost estimates had to be tailored to the specific type of operation contemplated.

This approach involved the development of costs from "ground level", starting with a work force, and associating it with costs necessary to perform operational functions. Cost of supplies, materials, fringe benefits and other expenses were also grouped into their respective operational functions. The costs associated with each operational function were determined at a 1979 level. Material, supply and equipment costs were derived by using estimates from a number of suppliers. Wage rates and benefits were established based on railroad operations in the St. Louis area. Other costs were furnished by either suppliers and contractors, or from regional averages if the former were not available.

As in the case of the other common facilities, TOFC operating costs were also allocated among the various railroads involved with the proposed common TOFC facility. Again, these allocations of operating costs to individual railroads were based on the roads' projected usage of the facilities and services encompassed by this type of operations.

Common Transfer Costs:

One significant operating cost not accounted for to this point is the cost associated with transfer crews and equipment involved in train

operations within the study area which were not comprehended in the yard and corridor simulation processes. These costs include the idle time that transfer crews and equipment spend waiting in yards between their runs and being transported from one assignment to the next. Because the number of transfer train movements varies significantly between restructuring alternatives, the cost associated with these operations would also vary; and thus it was necessary to estimate these costs in order to develop an accurate overall cost picture for common operations related to the various restructuring alternatives.

The estimation of costs was conducted for each of the major common switching entities (TRRA, A&S, New Yard, and TOFC), as well as for the St. Louis Terminal Area as a whole, under each alternative restructuring plan. As with other common operating costs, the cost of these common transfers was allocated among the linehaul roads, in relation to the involvement of their traffic in common transfer movements.

Related Home Yard Operating Costs:

The primary focus of CONSAD's operations and cost analyses, throughout the study, has been the common facilities and services within the St. Louis Terminal Area. The operational and cost impacts resulting from the restructuring of common facilities and operations will have a significant impact upon the costs of several individual roads' operations within the terminal. It was therefore necessary to make estimates of the magnitude of these costs, under each of the restructuring alternatives, in order to accurately assess the overall cost impacts and measure the cost effectiveness of implementing any one of the proposed alternatives.

This was accomplished by using estimates of the labor force required in the Year 2000 under each alternative. Annual cost factors, which included wages, fringes benefits, material and suppliers, were applied to the labor force estimates to determine labor based costs. The number of switch locomotives each road required for its own operation was estimated based on the labor data to determine equipment capital costs. Car

detention was drawn from CONSAD's traffic data to determine car hire cost. Where an individual road's facilities are part of the "common" operations, the estimate described above was reduced by the amount estimated for that common facility (e.g., ICG's line between Q Tower and Valley Junction is part of the common corridor system).

System Operating Costs:

In evaluating the impact of effectiveness of a restructuring alternative with respect to operating cost, the most significant cost figure is that for the study area as a whole. Through the use of CONSAD's costing methodologies, operating costs, both in total and for each of the separate activity/cost accounts, for each operating unit within the various components (yards, corridors, etc.) of the terminal system were estimated. Because the operating cost estimates for all of the various operating units were in a consistent format, all with costs estimated for the same activity/cost accounts and in 1979 dollars, the development of component and system costs was a straight-forward matter.

As a result of this process, CONSAD was able to provide cost data at three basic levels of detail, that of individual operating units, operational components of the system, and the system as a whole, for each of the alternatives and years analyzed. Costs, at each level of detail, were also determined for each of the major activity/cost accounts, as well as operating totals. All of this permitted comparisons of costs between restructuring alternatives at both gross and relatively fine levels of detail and allowed differences in overall cost to be traced to specific operating units, components or activities.

Total system costs for each individual railroad within the system were also determined. System costs for railroads were arrived at in roughly the same manner as described above, using the portion of the costs of each common operating unit allocated to each road and the estimated home road costs for each road as the bases from which to begin aggregating costs. The methodology employed is fully reported in the second volume of this Technical Supplement, Rail Operations Analysis.

SUMMARY AND CONCLUSIONS

The analyses performed in Phase II led to two major conclusions:

- Implementing any of the Build Alternatives would be more favorable with regard to rail operations than continuing with the current (No-Build) facilities and strategies

- The Three-Yard Bidirectional Alternative shows the most improvement when compared to the No-Build on the bases of transit time, reliability and cost of operations.

Table I summarized the major differences among the alternatives in yard capacity, while Table VI showed one major operational benefit of the restructuring project. It is widely-accepted that to improve efficiency in a rail terminal, it is vital to reduce the number of times a car is handled. From Table VI, it can be seen that the reduction in total car-handlings under the build alternatives is remarkable, and would represent a major benefit, and a major increase in expected reliability.

Table VII summarizes the performance across the three major measures of effectiveness (transit time, reliability as indicated by the percent of cars meeting their schedules, and operations cost), as well as across othr major indicators (corridor speed and total car handlings).

Finally, Table VIII relates the capital costs of the Alternatives, and presents an initial assessment of benefit/cost ratios and internal rates of return.

The results of the studies performed to date clearly indicate that a cost-effective investment can be made in the St. Louis terminal area, and that, through implementation of the project, the three goals on which the project is based can be attained, and great benefits can accrue to the local communities, the Region, the rail industry, and the Nation.

TABLE VIII

ALTERNATIVES COSTS[5]
($ Million)

	Alternatives			
	No-Build	Two-Yard Directional	Three-Yard Directional	Three-Yard Bidirectional
Direct Capital Cost [1]	NA	$531.16	$604.65	$581.08
Associated Capital Costs [2]	NA	94.26	89.34	87.52
Total	NA	$625.42	$693.99	$668.60
Annual Operating Costs	$379.36	$251.31	$245.33	$223.82
Difference from No-Build	NA	-$128.05	-$134.03	-$155.54
Benefit-Cost Ratio [1,3,4]	NA	1.68	1.53	1.85
Internal Rate of Return [3,4]	NA	14.4	13.6	15.3

Notes:

1 Costs includes only direct rail investments in facilities and not the necessary costs listed in Note 2, below. See Note 5.

2 Includes rail-related costs such as relocation of Illinois Route 3, grade separations and mitigation of some environmental impacts. These items might be partially publicly funded.

3 Includes new car-hire cost and labor protection payments.

4 Based on direct rail costs; assumes 10% discount rate, since this is the rate specified by U.S. DOT in Discount Rates to be Used in Evaluating Time-Distributed Costs and Benefits, Order DOT 5000.1.

5 Late reconsideration of engineering standards resulted in reducing the estimates of direct rail costs. For example, the Three-Yard Bidirectional alternative has been re-estimated at $460 million direct rail, instead of the $581.08 million. The Internal Rate of Return on that alternative rose to 22.8% as a result.

ISSUES TO BE RESOLVED

On basis of the above information, the RTAC recommended approval of the Three-Yard Bidirectional Alternative at their February 25, 1981, meeting. This vote was conditioned on resolution of Southern Railroad's need to maintain the integrity of its Venice and Carondelet main line, and Chicago and Northwestern Railroad's responsibility to switch certain industries in the National City area. Neither condition is seen as an insurmountable obstacle and work is proceeding to a resolution of these questions.

In order to proceed with the implementation of any alternative, certain basic issues must be resolved. The first is the institutional (corporate) changes that should occur with respect to the railroads. The RTAC perceived that the Two- and Three-Yard Directional Alternatives would require a closer communication and coordination between the operators of the two common yards than has existed previously. The large volume of cars, locomotives, and cabooses to be transferred between the two yards would necessitate a good deal of interaction between the A&S and the TRRA. On the other hand, the Three-Yard Bidirectional Alternative was perceived by RTAC as requiring no institutional changes.

The second issue to be resolved concerns an entity to operate the common TOFC facility. Kirkland and Ellis, the law firm retained by IDOT in this project, recommends a separate corporation. Either of the classification yard operators (or, for that matter, one or more linehaul carriers) could also manage the construction and operation of this facility.

The third issue requiring resolution is the order in which improvements should be undertaken. If full and immediate implementation of a build alternative were decided upon, an eight year construction period would be necessary. The magnitude of the total undertaking suggests that a lengthy construction schedule should be assumed, and that interruptions caused by changing economic conditions and other items might be expected.

Thus, the most logical construction staging plan would see the actions which could produce the most attractive return (on a stand-alone basis) as among the first to be implemented. Such actions will be developed and recommended to decision-makers for review.

The fourth issue concerns the financing of the capital projects. The FRA has indicated that federal funding for this project would most likely be in the form of preference shares under the Rail Revitalization and Regulatory Reform Act of 1976. The degree to which other federal funding can be used is being determined. Individual railroad company financing of specific projects may hasten completion of the restructuring.